the alternate interstices elevated, pure black, spotted with ashy; antennæ reddish only at the base; legs black. Length 2 lines.

Besides the difference in colour, which in this genus is perhaps not very important, and the greater width, which attains its maximum at the junction of the prothorax with the elytra in this species, whilst in *A. rufipes* it is at about the upper third of the elytra, it is also distinguished by the joints of the club being very decidedly longer; both are also very nearly allied to *Aræcerus* Coffeæ*, F., which, however, is smaller and more convex, with proportionably longer antennæ, and generally has a patch of several longish grey hairs on the shoulders; from this I find it difficult to distinguish *Tropideres fragilis* of Mr. Walker, from Ceylon, the type of which is in my collection.

XLV.—*On the Arrangement of Zoophytes with Pinnated Tentacles.*

By Dr. J. E. Gray, F.R.S., V.P.Z.S., Pres. Ent. Soc., &c.

Considerable attention has been paid by various authors to the arrangement of the stony Corals (*Actinaria*), by MM. Milne-Edwards and Haime, and by Mr. Dana among others; but comparatively little progress has been made in the arrangement of the Zoophytes with pinnated tentacles, or *Alcyonaria*, since the time of Lamarck.

I have for years been studying these animals and the corals which they form, and have only been prevented from publishing the result of my studies by the desire to feel more sure with regard to the distinction between the species of the family of Gorgoniadæ, and to ascertain with greater certainty than I have yet been able the true synonymy of the species of the genera of that family.

In the meantime I would suggest the following arrangement of the families, as that which best explains the relation of the various genera to each other.

Order I. SABULICOLÆ.

Coral-tree symmetrical, with a simple base, supported by more or less distinct calcareous spicula, and strengthened by a single, fusiform, elongate, calcareous, central axis. Living with the base sunk in the sand or mud of the sea-coast.

Fam. 1. Pennatulidæ.

Body free, more or less pen-like, with a naked peduncle and a

* More correctly *Arœocerus*; but I hold that the orthography of the original authority ought never to be departed from, except in the case of some very gross and insufferable blunder. Schönherr first proposed *Arœcerus* in his "Curculionidum Dispositio Methodica," p. 40, and repeated it without alteration in his "Synonymia."

single central axis. The upper part with the polypes placed in transverse series on one, rarely on all sides. Axis fusiform, elongate, cylindrical and quadrangular, calcareous, as long as the coral.

Dana divides the Pennatulidæ into two subfamilies:—1. Pennatulinæ, polypes retractile; 2. Pavoninæ, polypes not retractile (including *Pavonia* and *Umbellularia*)! I may observe here that I do not think the character derived from the retraction and non-retraction of the polypes is of much importance; for it is observed that all the *Gorgoniæ* figured by Ellis from specimens preserved in spirits have the polypes expanded, and it is the same with most *Pennatulæ* and many *Alcyonia*.

I. *Penniformes*. The coral pen-shaped. The polypes in transverse pinnules, placed on each side of the ventral surface of the central rachis or stem.

Tribe 1. Funiculineæ. The coral elongate, linear, slender; the pinnules small, crowded.

Funiculina. Virgularia. Lygus. Scytalium.

Tribe 2. Pennatuleæ. The coral moderately broad, pen-shaped; the pinnules broad, expanded.

**Pennatula.* ***Sarcoptilus. Pteromorpha. Pteroeides.*

II. *Claviformes*. The coral club-shaped or leaf-like. The polypes scattered on one side (rarely on both) of the upper part of the club.

Tribe 3. Kophobelemnonieæ. The coral club-shaped, with the polypes only on one surface of the club, leaving the other bare.

Kophobelemnon.

Tribe 4. Veretilleæ. The coral club-shaped. The polypes on all sides of the club.

Lituaria. Sarcobelemnon. Cavernularia. Veretillum.

Tribe 5. Renilleæ. The coral expanded, foliaceous, with a slender stalk. The polypes only on one surface of the expanded disk.

Renilla.

Fam. 2. **Umbellulariadæ.**

The body free, umbellate, with a long stem and a single central axis. The upper part with a cluster of polype-bearing cells placed in concentric series, forming a large head. Axis fusiform, elongate, as long as the stem of the coral.

Umbellularia.

Order II. SPONGICOLÆ or HYALOPHYTA.

Subsymmetrical, living sunken by the base into a sponge, strengthened by silicious spicula, and supported by a central axis formed of numerous twisted, elongated silicious fibres.

The axis is formed of many twisted fibres, its lower end tapering, and parasitically imbedded in a fixed sponge, and thus kept in an erect position.

The animal matter or bark is strengthened by silicious spicula, similar to, but shorter and thinner than the fibres of the axis. The fibres are formed of numerous thin concentric layers.

Valenciennes and other French naturalists, overlooking the structure of the spicula in the bark, have regarded the latter as a parasitic kind of *Alcyonarium* growing on some unknown substance,—an idea that requires the belief in the existence of two peculiar bodies which are always found together and are unknown in any other state, instead of regarding them as parts of the same animal growth; this is proved to be the case not only by their being always found in union, but by the fact that the axis, which is supposed to be the supporting part, is of the same texture as the spines found in the bark, the one passing gradually into the other; and I have no doubt that, in the living state, the fibres of the axis are as much surrounded by flesh as the spicula in the bark itself.

Fam. 1. Hyalonemidæ.

Hyalonema.

Order III. RUPICOLÆ.

Coral tree-like or expanded, fixed by an expanded base, supported by more or less abundant fusiform calcareous spicula, and often supported by a central calcareous or horny tree-like axis with an expanded base. Living attached by the base of the coral and axis to rocks on the sea-shore.

This order is divided into three suborders.

Suborder I. Lithophyta.

Coral arborescent, supported by a continuous or jointed calcareous axis, which effervesces with muriatic acid.

† *Axis continuous, not jointed.*

Fam. 1. Coralliadæ.

Axis inarticulate, solid, calcareous. Bark granular, with irregular-shaped spicula.

**Corallium*. *Annella*. *Ellisella*. (*Junceella* and *Ctenocella*.) ?*Gorgonella*. *Scirpearia*. *Umbracella*. ***Subergorgia*.

Corallium
Ellisella Umbracella & Scirpearia

Fam. 2. **Primnoadæ.**

Axis inarticulate, solid. Bark formed of flat imbricate scales. Polype-cells prominent, covered with imbricate scales.

Primnoa. *Callogorgia.* *Primnoella.*

†† *Axis articulated.*

Fam. 3. **Melitæadæ.**

Axis spongy, permeated by flexuous tubular canals interrupted by harder, swollen, calcareous joints. Bark granular; cells in series on the edge of the branchlets.

Melitæa. *Mopsella.* ?*Solanderia.*

Fam. 4. **Isideæ.**

Axis calcareous, solid, divided by narrowed horny joints. Bark granular, with irregular-shaped spicula.

Isis (*Cynosaire*). *Isidella.* *Mopsea.*

Suborder II. Ceratophyta.

Coral arborescent, supported by a continuous (or jointed?) horny axis, which does not effervesce in muriatic acid.

Fam. 1. **Gorgoniadæ.**

Bark granular, persistent, with sunken irregular-shaped spicula, with a more or less distinct groove down each side, and with the cells in series on each side of the branchlets.

* *Coral arborescent or reticulated; cells on side of the branchlets.*

Gorgonia. Arborescent; branchlets subcompressed; cells on side, moderate.

Pterogorgia. Arborescent; branchlets much compressed; cells minute, on edge.

Rhipidogorgia. Reticulated, fan-like; cells on sides.

** *Coral frondose; cells on surface of frond.*

Hymenogorgia. Axis branched, filiform, branches separate.

Phyllogorgia. „ „ branches netted.

Phycogorgia. Axis expanded, foliaceous, thin.

Fam. 2. **Plexauridæ.**

Bark granular, persistent, cork-like, without any impressed lateral grooves. Cells placed equally on all sides of the branches.

Plexaura (*Bebryce*). Cells not raised, simple.

Rhinogorgia. Cells not raised, bounded by a conical process.

Eunicea. Cells more or less produced, simple.

Gonidora. Cells convex; mouth radiated.

Fam. 3. **Muriceidæ.**

Bark composed of large imbricate calcareous spicula, without any lateral grooves. Cells equally on all sides of the branchlets.
Muricea. Plexaurus?

Fam. 4. **Acanthogorgiadæ.**

Bark thin, formed of slender filiform spicula, without any lateral grooves. Cells campanulate, on all sides of the branches, with ridges of elongated spicula, and with a number of elongate setaceous spines on the margin.
Acanthogorgia.

? Fam. 5. **Antipathidæ.**

Bark fleshy, easily deciduous, soft, simple, only strengthened by large and small, scattered, silicious? plates.
Leiopathes. Antipathes.

I have observed pinnate tentacles in *Leiopathes*, and indications of them in one *Antipathes*. Dana describes them as simple in two species of *Antipathes* which he saw alive; so that the position of this family is open to doubt.

Fam. 6. **Sarcogorgiadæ.**

Bark fleshy, when dry skin-like, smooth, without spicula; the edges of the cells strengthened with granular spicula.
Sarcogorgia.

Suborder III. SARCOPHYTA.

Coral arborescent, lobulated or expanded, only strengthened by internal or external calcareous spicula, which effervesce in acid.

Fam. 1. **Briareidæ.**

Coral arborescent, fleshy, supported by a central axis formed of numerous intertwined fusiform spicula.
Briareum.

Fam. 2. **Alcyoniadæ.**

Coral arborescent or lobed, fleshy, strengthened with imbedded calcareous spicula. Cells simple. Polype retractile or semi-retractile.
Alcyonium (*Lobularia*). *Sympodium. Ammothea.*

Fam. 3. **Xeniadæ.**

Coral expanded or arborescent, fleshy, soft, creeping or branched. Polype elongate, subcylindrical. Tentacles not retractile.
**Xenia. Anthelia. Rhizoxenia. Evagora.* ***Cornularia.*

Fam. 4. **Nephthyadæ.**

Coral arborescent or expanded, fleshy, membranaceous, often very cellular. Cell of the polypes covered externally with large fusiform calcareous spicula.

**Nephthya* (*Spoggodia*). ? *Alcyonidia.* ***Nidalia.* ****Clavularia.*

Fam. 5. **Tubiporidæ.**

Coral calcareous, tubular. Tubes united by transverse plates formed by the expanded edges of the tubes bearing the buds. Polypes cylindrical.

Tubipora.

XLVI.—*On the Arrangement of the Polarizing Microscope in the Examination of Organic Bodies.* By Hugo von Mohl*.

That polarized light is so rarely made use of in the microscopic examination of organic bodies, principally arises from the circumstance that the German and French microscopes, which are almost exclusively used on the Continent, are so badly arranged as to be almost valueless for detecting double refraction in those organic structures which act but feebly upon polarized light. Hence, to mention a few instances, Ehrenberg was unable to detect this property in the leaf-scales of *Olea Europæa,* and in the silicious valves of the Diatomaceæ; nor could Schacht discover double refraction in the primary membrane of the cells of plants; and Pereira, who occupied himself so much with polarized light, was unable to see the black cross in the starch-granules of rice; whilst these structures under my polarizing microscope form most beautiful objects, so that not only can I resolve the lines in *Pleurosigma angulatum* into dots, as well as with common light, but their six-sided form is quite distinct.

Even in my first attempts to use this instrument in phytotomic experiments, I found that a bright and distinct image could be obtained only by exposing the object to very concentrated polarized light. The necessity of this is evident from the fact that three-fourths of the light reflected by the mirror is necessarily lost in its passage through the polarizing apparatus, which loss must be considerably increased by the reflexion taking place at the surfaces of the lenses of the microscope. When, moreover, it is remembered that the depolarizing action of most organic structures is much more feeble than that of inorganic crystals, it may be easily understood that the image of the former is dull and imperfect, or that they remain invisible, if very intense illumination is not applied. Experiment also convinced

* Translated from Poggendorff's Annalen, No. 9. 1859, p. 178.